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New records of *Puccinia* on *Poaceae* from Khyber Pakhtunkhwa, Pakistan

A. Ishaq[1*], N.S. Afshan[2] & A.N. Khalid[1]

[1*]*Department of Botany &* [2]*Centre for Undergraduate Studies, University of the Punjab, Quaid-e-Azam Campus, Lahore, 54590, Pakistan*

*Correspondence to: *aamna_ishaq@yahoo.com*

Abstract —*Puccinia arthraxonis-ciliaris* and *P. pseudocesatii* were collected from Khyber Pakhtunkhwa and are new records for Pakistan.

Key words — Naran, *Pucciniales*, rust fungi

Introduction

Khyber Pakhtunkhwa (KPK), formerly known as the Northwest Frontier Province (NWFP), is one of the five provinces of Pakistan, located in the northwest of the country. It is situated at approximately 34.00°N 71.32°E (Fig. 1). Khyber Pakhtunkhwa is famous for hill coniferous forests, herbal plants, and large biodiversity. This floristically rich area is affected by many biotic and abiotic stresses including plant diseases such as leaf blights, red rot, smut, mosaic, and rust (Asad et al. 2007). One hundred seventy taxa of rust fungi have been reported from this area (Afshan & Khalid 2008, 2009; Afshan et al. 2007, 2008a,b,c,d, 2010; Khalid & Afshan 2009; Ahmad et al. 1997; Iqbal et al. 2008). The number of rust species recorded from this area is expected to increase in future due to extensive exploration.

We describe below three new rusts from Khyber Pakhtunkhwa that bring the total rust taxa recorded from the area to 173: *Puccinia pseudocesatii* on *Dichanthium annulatum* and *P. arthraxonis-ciliaris* on *Arthraxon* sp. (both new records for Pakistan) and *P. helictotrichi* var. *pakistanica* on *Helictotrichon junghuhnii*.

Materials & methods

During an exploration of the rust diversity in KPK, rust infected plants and their inflorescences were collected from different areas of the province and compared morphological with earlier herbarium collections. Freehand sections & scrape mounts

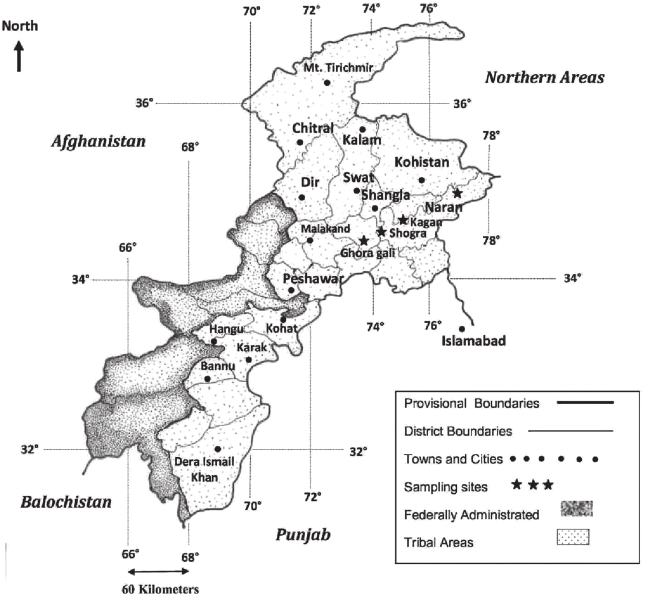

Figure 1: Map of Khyber-Pakhtunkhwa showing sampling sites.

of infected plant materials were made in lactic acid. The plants were photographed and infected portions were observed under stereomicroscope. Twenty spores of each spore state were examined under microscope (Nikon YS 100) and paraphyses and spore dimensions were taken by an Ocular micrometer (Zeiss Eyepiece Screw Micrometer). Sections, paraphyses and spores were microphotographed by digiporo-Labomed. Illustrations of spores and paraphyses were made under Lucida camera (Ernst Leitz Wetzlar Germany).

New records

Puccinia arthraxonis-ciliaris Cummins, Uredineana 4: 16 (1953) Fig. 2

Spermogonia, aecia & uredinia not found. Telia amphigenous, black, scattered. Teliospores ellipsoid to oblong-ellipsoid, light brown, 1–2 celled, mostly 2–celled spores (19–)21–28 × 42–49(–57) µm; apex 6–10 µm thick; wall 2–4 µm thick; pedicel hyaline, 5–9 × (23–)29–54 µm. 1-celled spores 21–26 (–31) × (26–)34–38 µm; apex 7–10 µm thick; wall 2–3 µm thick; pedicel up to 44 µm long.

Material examined: **PAKISTAN, Khyber Pakhtunkhwa**, Ghora gali, 1691 m a. s. l., on *Arthraxon* sp., stage III, 30 April 2008. A. Ishaq AM69 (LAH 1166).

Comments: *Puccinia arthraxonis-ciliaris* has previously been reported on *Arthraxon hispidus* (Thunb.) Makino from China, India, Japan, Mauritius,

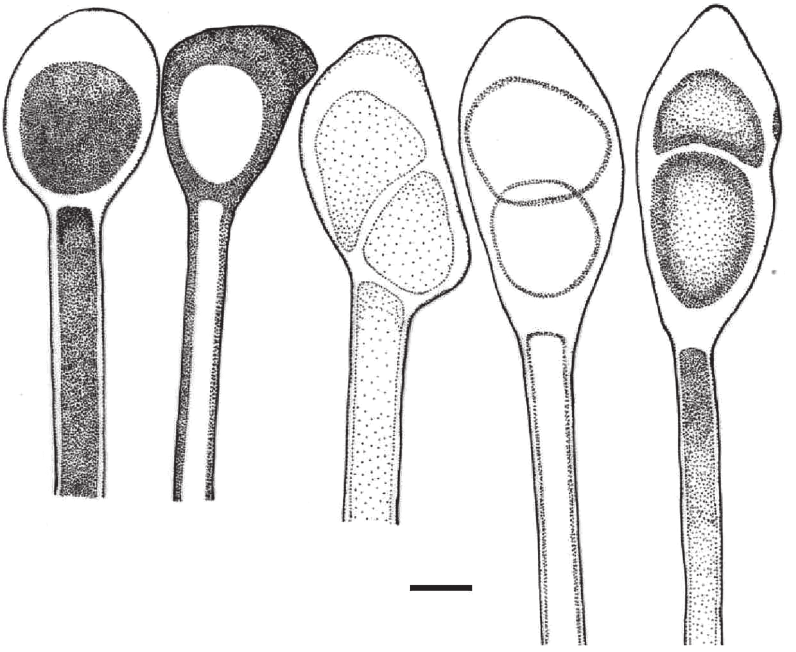

Figure 2: *Puccinia arthraxonis–ciliaris*. Teliospores. Scale bar = 14 µm.

New Guinea, and Philippines (Cummins 1971 and represents a new species record for Pakistan. *Puccinia arthraxonis* (Henn.) Syd. et al. has previously been reported from Pakistan on different *Arthraxon* species (Ahmad 1976; Khalid et al. 1993).

Puccinia pseudocesatii Cummins, Uredineana 4: 71 (1953) Fig. 3

Spermogonia, aecia & uredinia not found. Telia amphigenous, pulvinate, black. Teliospores ellipsoid, hyaline to light brown, 2-celled, 3-celled rarely, 10–20 × (35–)44–60 µm, sometimes upper cell is wider than lower one, 10–27 µm wide; apex 5–15(–18) µm thick; wall 1.5–2 µm thick; pedicel hyaline, fragile, 5–8 × 23–67 µm.

Material examined: **PAKISTAN**, **Khyber Pakhtunkhwa**, Ghora Gali, 2009 m a.s.l., on *Dichanthium annulatum* (Forssk.) Stapf, stage III, 29 March 2009, A. Ishaq AM31 (LAH 1172)

Comments: *Puccinia pseudocesatii* has previously been reported on *Bothriochloa ischaemum* (L.) Keng and *Chrysopogon gryllus* (L.) Trin. from southern Europe

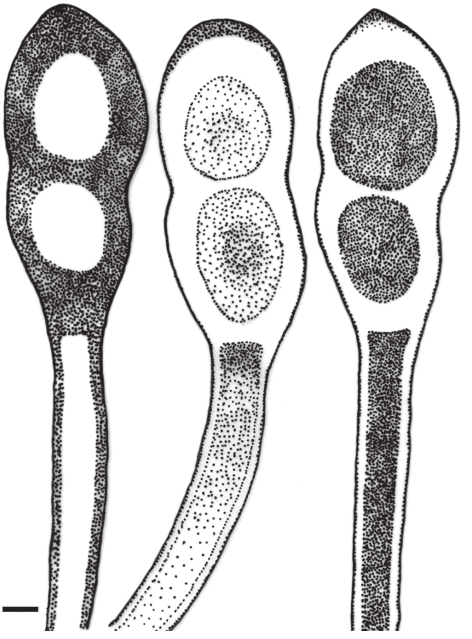

Figure 3: *Puccinia pseudocesatii*. Teliospores. Scale bar = 17 µm.

(Cummins 1971). From Pakistan, *P. cesatii* J. Schröt., *P. duthiei* Ellis & Tracy, *P. dichanthii* Afshan & Khalid, *Uromyces andropogonis-annulati* Syd. et al. and *U. clignyi* Pat. & Har. have previously been reported on *Dichanthium annulatum* (Ahmad 1956a,b; Hasnain et al. 1959; Ghaffar and Kafi 1968; Afshan et al. 2010).

This is a new record for Pakistan and *Dichanthium annulatum* represents a new host for this rust fungus.

Puccinia helictotrichi* var. *pakistanica Afshan & Khalid, Mycotaxon 112: 487 (2010) Fig. 4

Spermogonia and aecia unknown. Uredinia scattered on whole leaf surface, naked, amphigenous, golden brown. Urediniospores globose to subglobose, hyaline, 15–24 × 20–26 µm; wall 1.5–3 µm thick, hyaline, echinulate; germ pore obscure. Telia amphigenous, golden brown, loculate, 100–200 × 40–80 mm. Teliospores elongated to cylindrical, 14–24 × 36–49 µm; apex 2–3.7 µm thick; wall 1.5–3 µm thick; pedicel hyaline, 3–7 × 3.3–13 µm.

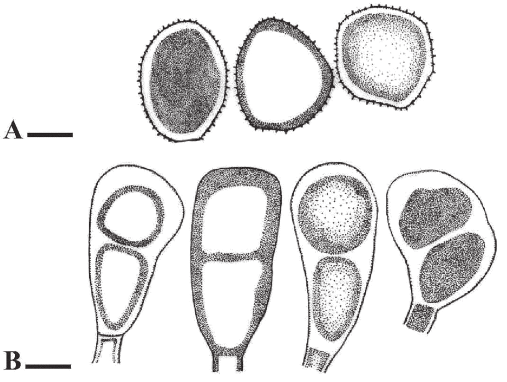

Figure 4: *Puccinia helictotrichi* var. *pakistanica*.
A. Urediniospores showing echinulate surface ornamentation. B. Teliospores.
Scale bars: A = 9 µm; B = 10 µm.

Material examined: **PAKISTAN**, **Khyber Pakhtunkhwa**, Shogran, 2362 m a.s.l., on *Helictotrichon junghuhnii* (Buse) Henrard (= *H. asperum* (Munro ex Thwaites) Bor), stages II & III, 28 August 2010, A. Ishaq AM04 (LAH 1145); Naran, 2427–3200 m a.s.l., on leaves of *Helictotrichon* sp., stages II & II, 29 August 2008, A. Ishaq AM15 (LAH 1149).

Comments: *Puccinia helictotrichi* var. *pakistanica* has been previously reported on *Helictotrichon junghuhnii* (= *H. virescens* (Nees ex Steud.) Henrard) from Fairy Meadows, Northern Areas (Afshan et al. 2010). This represents a new record for Khyber Pakhtunkhwa.

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